

IP4220CZ6

Dual USB 2.0 integrated ESD protection to IEC 61000-4-2 level 4

Rev. 03 — 12 July 2005

Product data sheet

1. Product profile

1.1 General description

The IP4220CZ6 is designed to protect I/O lines sensitive to capacitive load, such as USB 2.0, ethernet, DVI etc. from damage due to ElectroStatic Discharge (ESD). It incorporates four pairs of ultra-low capacitance rail-to-rail diodes plus an additional Zener diode to provide protection to signal and supply components from ESD voltages as high as ± 8 kV contact discharge. Protection is supply voltage independent due to the rail-to-rail diodes being connected to the Zener diode. The IP4220CZ6 integrates four pairs of ultra-low capacitance rail-to-rail ESD protection diodes in a miniature 6-lead SOT457 package.

1.2 Features

- ESD IEC 61000-4-2 level 4, ± 8 kV contact discharge compliant protection
- Four pairs of ultra-low input capacitance (1 pF typ.) ESD rail-to-rail protection diodes
- Low voltage clamping due to integrated Zener diode
- Small 6 lead SO6 (SOT457) package
- IEC 61000-4-5 15A Lightning (8/20 μ s)

1.3 Applications

- General-purpose downstream ESD protection for high frequency analog signal ports and high-speed serial data transmission ports in:
 - ◆ Cellular and PCS mobile handsets
 - ◆ PC-/notebook USB 2.0/IEEE1394 ports
 - ◆ DVI interfaces
 - ◆ Cordless telephones
 - ◆ Wireless data (WAN/LAN) systems
 - ◆ PDAs
 - ◆ HDMI

PHILIPS



2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1	ESD protection I/O 1		
2	GND		
3	ESD protection I/O 2		
4	ESD protection I/O 3		
5	Supply voltage V_P		
6	ESD protection I/O 4		

001aac379

3. Ordering information

Table 2: Ordering information

Type number	Package		
	Name	Description	Version
IP4220CZ6	-	plastic surface mounted package; 6 leads	SOT457

4. Limiting values

Table 3: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{I/O}$	I/O DC input voltage		0	5.5	V
V_{esd}	electrostatic discharge; all pins	IEC 61000-4-2, level 4, contact	-8	+8	kV
T_{stg}	storage temperature		-55	+125	°C

5. Recommended operating conditions

Table 4: Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb}	ambient temperature		-40	-	+85	°C

6. Characteristics

Table 5: Characteristics

$T_{case} = 25\text{ }^{\circ}\text{C}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{I/O(n)}$	pin capacitance to ground, pins 1, 3, 4 and 6	$V_{I/O(n)} = 0\text{ V}$; $f = 1\text{ MHz}$; $V_P = +3.0\text{ V}$	-	1.0	-	pF
$I_{L(n)}$	diode reverse leakage current, pins 1, 3, 4 and 6 to ground	$V_{I/O(n)} = +3.0\text{ V}$	-	-	100	nA
$C_{d(\text{Zener})}$	Zener diode capacitance to ground, pin 5 to pin 2	$V_{I/O(n)} = 0\text{ V}$; $f = 1\text{ MHz}$; $V_P = +3.0\text{ V}$	-	40	-	pF
$V_{BR(\text{Zener})}$	Zener diode breakdown voltage, pin 5 to pin 2	$I = 1\text{ mA}$	6	-	9	V
V_F	forward voltage		-	0.7	-	V

7. Application information

7.1 Universal serial bus 2.0 protection

The IP4220CZ6 is optimized to protect, for example, two USB 2.0 ports from ESD. Each device is capable of protecting both USB data lines and the V_{BUS} supply. A typical application is shown in [Figure 1](#).

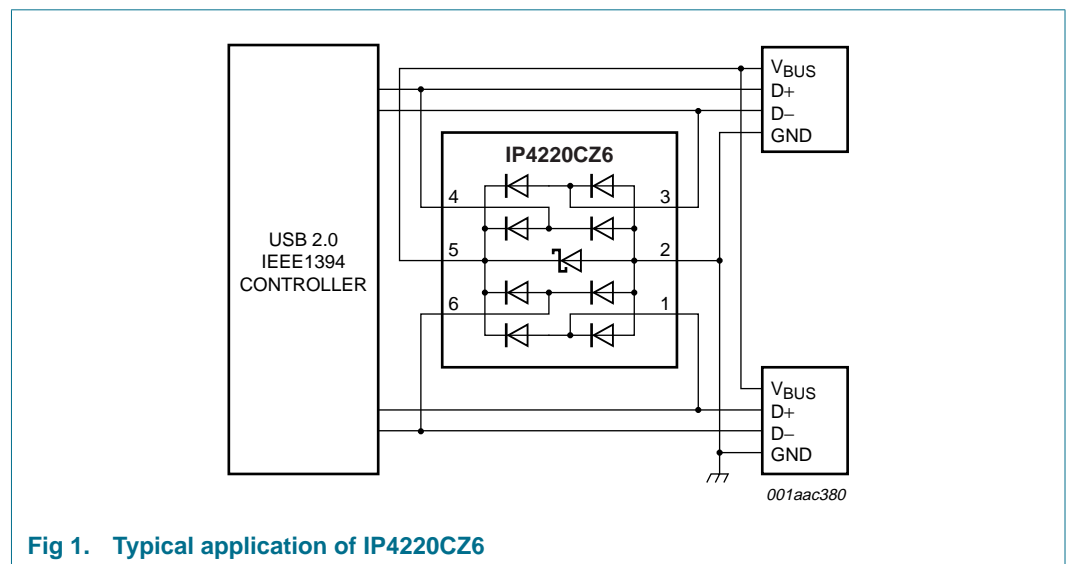


Fig 1. Typical application of IP4220CZ6

7.2 IP4220CZ6 spice model

Table 6: Diodes spice parameters

Symbol	Parameter	Value										Unit
		D1	D2	D3	D4	D5	D6	D7	D8	DZ		
CJO	zero-bias junction capacitance	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	27	pF	
VJ	junction potential	650	778	650	778	650	778	650	778	640	mV	
M	grading coefficient	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	-	
BV	reverse breakdown voltage	50	50	50	50	50	50	50	50	7.3	V	

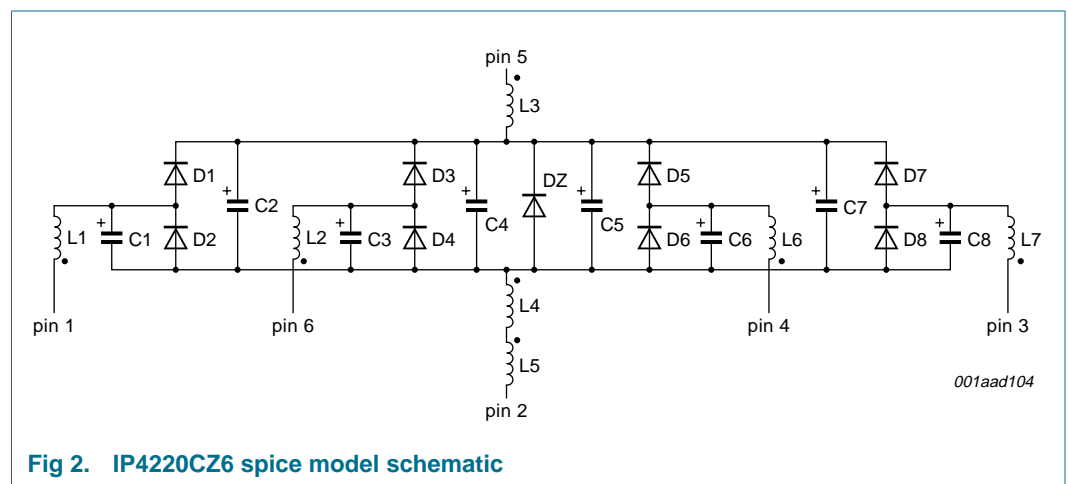


Fig 2. IP4220CZ6 spice model schematic

Table 7: Spice model list of components; see [Figure 2](#)

Component	Parameter	Value	Unit
L1	inductance	880	pH
	resistance	200	mΩ
L2	inductance	800	pH
	resistance	200	mΩ
L3	inductance	440	pH
	resistance	200	mΩ
L4	inductance	480	pH
	resistance	200	mΩ
L5	inductance	800	pH
	resistance	200	mΩ
L6	inductance	640	pH
	resistance	200	mΩ
L7	inductance	640	pH
	resistance	200	mΩ
C1		160	nF
C2		160	nF
C3		160	nF

Table 7: Spice model list of components; see [Figure 2](#) ...continued

Component	Parameter	Value	Unit
C4		160	nF
C5		160	nF
C6		160	nF
C7		160	nF

8. Package outline

Plastic surface mounted package; 6 leads

SOT457

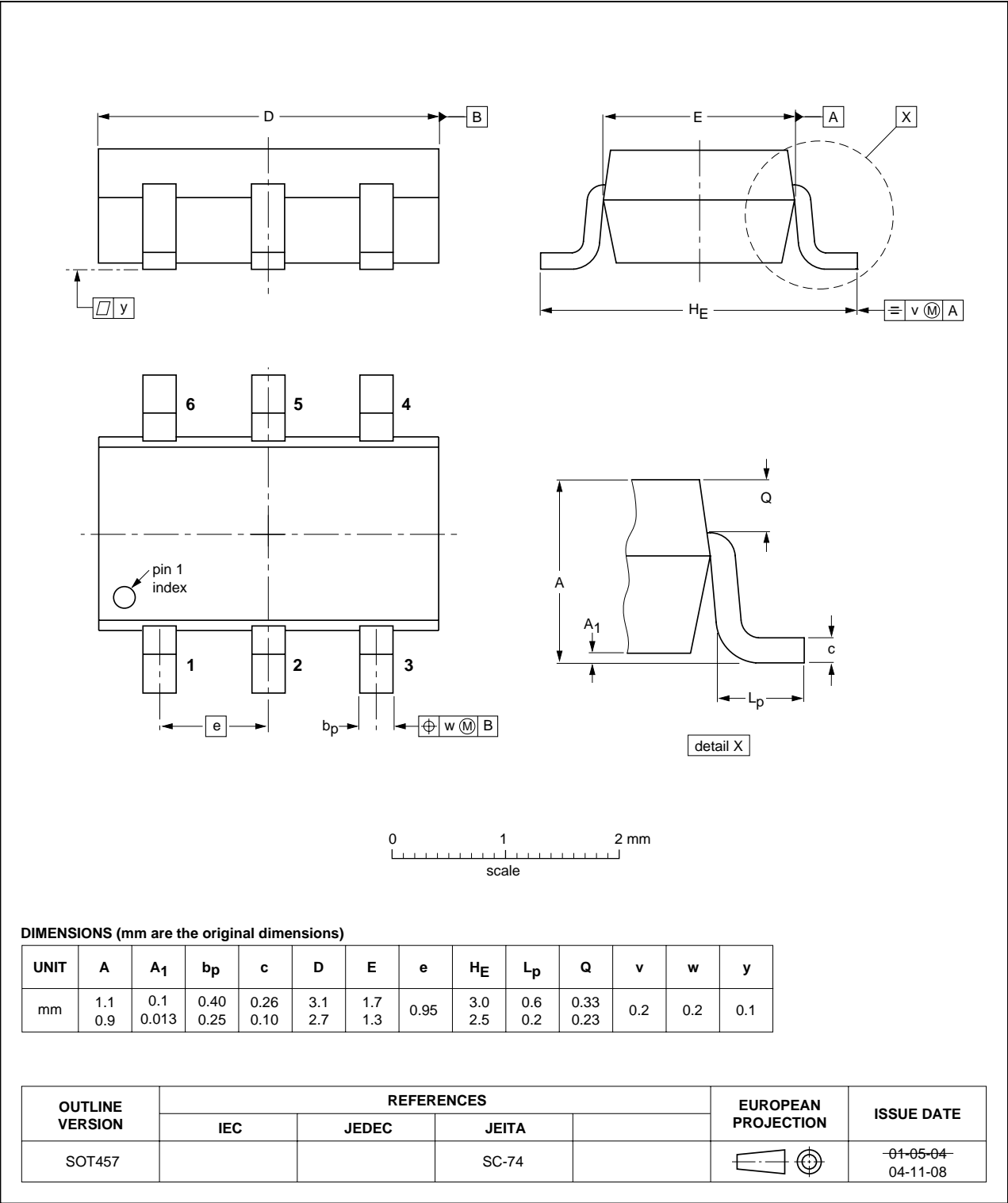


Fig 3. Package outline SOT457

9. Abbreviations

Table 8: Abbreviations

Acronym	Description
DVI	Digital Video Interface
HDMI	High Definition Multimedia Interface
LAN	Local Area Network
PCS	Personal Communication System
PDA	Personal Digital Assistant
USB 2.0	Universal Serial Bus 2.0
WAN	Wide Area Network

10. Revision history

Table 9: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
IP4220CZ6_3	20050712	Product data sheet	-	-	IP4220CZ6_2
Modifications:					
• Table 4 “Operating conditions” : maximum value for T_{amb} changed from +80 °C to +85 °C.					
IP4220CZ6_2	20050608	Product data sheet	-	9397 750 14555	IP4220CZ6_N_1
IP4220CZ6_N_1	20040917	Preliminary specification	-	n.a.	-

11. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

12. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

14. Trademarks

Notice — All referenced brands, product names, service names and trademarks are the property of their respective owners.

13. Disclaimers

Life support — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors

15. Contact information

For additional information, please visit: <http://www.semiconductors.philips.com>

For sales office addresses, send an email to: sales.addresses@www.semiconductors.philips.com

16. Contents

1	Product profile	1
1.1	General description	1
1.2	Features	1
1.3	Applications	1
2	Pinning information	2
3	Ordering information	2
4	Limiting values	2
5	Recommended operating conditions	2
6	Characteristics	3
7	Application information	3
7.1	Universal serial bus 2.0 protection	3
7.2	IP4220CZ6 spice model	4
8	Package outline	6
9	Abbreviations	7
10	Revision history	8
11	Data sheet status	9
12	Definitions	9
13	Disclaimers	9
14	Trademarks	9
15	Contact information	9



© Koninklijke Philips Electronics N.V. 2005

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Date of release: 12 July 2005
Document number: IP4220CZ6_3

Published in The Netherlands